faced with regulations imposed mid-stream that completely alter risk/return expectations in ways that were impossible to foresee. If the FCC excludes intangible assets and past financial losses from its definition of allowable costs for cost-of-service ratemaking, existing operators will not be able to recover their investments consistent with legitimate, market-based expectations at the time the investments were made.[11] More importantly for the customers, such exclusions would significantly reduce investors' and lender's incentives to commit capital to this industry for improvements to cable service. If investors and lenders believe that FCC regulation can confiscate investments in cable service, they will make no more investments. The result will be reduced service to customers, and reduced competition for the "information highways" of the future.

The FCC cannot simply impose traditional rate of return regulation in mid-stream. If investors cannot recover these losses, operators will not earn a fair return on their cost of capital, a necessary element of which is the risk premium. If the FCC fails to allow the recovery of such losses, the development of new technology and services will be stifled. Again, the need for transitional rules are clear.

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[11] Existing accounting practices recognize the necessity of pre-operating losses. For example, FASB 51, Financial Reporting by Cable Television Companies, requires the capitalization of certain CATV system start-up expenses (losses) to the appropriate tangible and intangible asset accounts. See, Declaration of John E. Kane, Exhibit 4.

3. Depreciation

The FCC tentatively concludes that it should prescribe depreciation rates for the cable industry based on the book values of the assets. NPRM at ¶ 27. As an alternative, the FCC asks whether it should initially monitor the industry's depreciation practices and require operators to explain their depreciation schedules in their cost-of-service showings. NPRM at ¶ 29.

The Group believes that the restraints placed on cable operators by GAAP requirements are sufficient to meet the FCC's regulatory goals. Cable company depreciation rates should be presumed reasonable for a number of reasons. First, since cable television rates have been unregulated since 1984, there is no reason to presume that cable company depreciation rates set in an unregulated environment would be unreasonable. Unlike entities subject to traditional cost-of-service regulation, cable companies have not had the incentive to structure their accounting to increase current revenue requirements.

Second, restraints imposed by GAAP provide sufficient internal and external control over future depreciation practices. Existing GAAP rules are already designed to meet the FCC's stated goal to require depreciation "to accurately reflect, and recover the costs of the asset over, its useful life." NPRM at ¶ 28. Moreover, a 1986 study by Ernst & Whinney (the predecessor firm to E&Y) showed that the depreciation practices of the cable

industry were similar among companies, and did not misstate depreciation.[12]

Third, the administrative burden placed on cable operators, local franchise authorities and the FCC far outweigh the benefits, if any, of FCC prescription of depreciation rates. Traditionally, telephone common carriers have been required to submit detailed historical depreciation studies, consisting of 600 pages or more, on a tri-annual basis to support depreciation rates. The Commission itself has recognized that prescribing deprecation rates is an extremely burdensome activity, requiring RBOCs and large telephone companies to spend together $35-$50 million annually on administrative compliance with FCC depreciation requirements.[13] If the cost benefit analysis does not work for telephone companies, it is even less appropriate for historically unregulated cable companies.

Fourth, and finally, the Group has retained Ernst & Young to conduct comprehensive cost analysis of cable systems operated by certain members of the Group. Included in this analysis will be a discussion of depreciation practices by these systems, comparisons between systems and a discussion of existing safeguards under GAAP that prevent operators from arbitrarily

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[12] "Review of Depreciation Policies and Procedures in Selected Industries," Ernst & Whinney, 1986 attached hereto as Exhibit 6. Since the entire report is over 200 pages, only a copy of the Executive Summary is attached. A complete copy will be provided at the Commission's request.

[13] Simplification of Depreciation Prescription Process, "Notice of Proposed Rulemaking," CC Docket No. 92-296, 8 FCC Rcd. 146, n.9 (1992).

changing depreciation rates and methods. E&Y will also discuss the unnecessary administrative costs of changing to the depreciation practices employed by public utilities.

For these reasons, the Group strongly urges the Commission not to prescribe depreciation rates for cable operators. Rather, the FCC may, as necessary, monitor existing depreciation practices. Allowing operators to use GAAP to determine depreciation rates will further the FCC's goal of streamlining cost-of-service regulation.

VI. TREATMENT OF INCOME TAXES

The FCC proposes to allow operators to include as an annual expense income taxes paid by the business entity, but proposes to exclude income taxes paid by "individual owners, partners or Subchapter S corporations." NPRM at ¶ 30, n.32. Many of the Group's members and many of the industry's systems are operated as partnerships, and a significant number of cable operators operate as sole proprietorships and Subchapter S corporations. While the FCC does not articulate its rationale for excluding a tax allowance for these types of businesses, presumably the proposed rule is based on the fact that these entities do not incur income tax liability directly. However, the proposed rule ignores the undisputed fact that, like corporations, the economic activities undertaken by these types of entities have taxable consequences and result in the payment of federal and state income taxes. The proposed rules would

gravely penalize cable operators organized as partnerships, sole proprietorships and Subchapter S corporations.

For partnerships where the partners are corporations, the tax liability is the same as a corporation incurring the tax liability directly. Only the organizational form differs. In the case of partnerships, sole proprietorships, and Subchapter S corporations owned by individuals rather than corporations, tax liability is reported on the supporting schedules of individual, rather than corporate, tax returns. However, the only difference in the tax liability incurred is that individual tax rates (between 15 and 39.6%) apply, rather than the corporate tax rate of 35%. In this circumstance, the Group believes that it is appropriate to use individual, rather than corporate, tax rates to develop a tax allowance, but not to deny a tax allowance altogether.

At a minimum, the Commission should establish a transition period during which operators with non-corporate forms of organization would be permitted to include a tax allowance in their cost-of-service showing up to 5 years after the FCC adopts final cost-of-service standards. This would give non-corporate entities sufficient time to restructure their form of organization as a corporation.

VII. COST ALLOCATION AND TREATMENT OF CAPITAL IMPROVEMENTS

As noted earlier, the Group believes that the cost allocation rules established in the Report & Order are sufficient

to allow an operator to allocate costs between regulated and unregulated services. The existing rules require that costs be allocated to the franchise level in proportion to the number of subscribers in the franchise area, and that costs be allocated between tiers in proportion to the number of channels on each tier. 47 C.F.R. §§ 76.924(e)(1) and (2). The Group believes that most cable operators will choose the cost-of-service option only to initialize regulated rates. Once rates are initialized, the price cap mechanism, and appropriate provisions for the treatment of external costs, should provide operators with compensatory rates. More importantly, the need for flexibility is crucial in these early stages of rate regulation. The FCC should not limit itself by adopting extremely detailed and rigid criteria at a time when the record is still being developed on cable industry costs and accounting practices.

However, as the FCC recognizes, Congress has adopted a policy goal of ensuring that cable operators continue to expand and develop the telecommunications infrastructure and that cable operators are "rapidly making facilities and services improvements." NPRM at ¶ 9. As set forth below, the majority of the costs associated with upgrades and rebuilds are properly allocated to the regulated tiers because the capital improvements benefit <u>all</u> subscribers, and improve the essential distribution plant of the entire cable system.

First, the new 1992 cable technical standards will require most cable operators to upgrade their systems to comply

with the new rules.[14] As discussed in detail by David Large, Director of Engineering, InterMedia Partners, the increased standards for carrier-to-noise ratio and the new customer service standards regarding telephone response time will prompt upgrades in many instances. See, Declaration of David Large, Exhibit 5. For this reason alone, the costs of upgrades are properly allocated to the regulated tiers.

Second, the most economical way to achieve compliance with the new technical standards and customer service requirements will be fiber optic upgrades and rebuilds. State-of-the-art fiber optic equipment will generally support 550 MHz bandwidth (approximately 78 video channels) on a single fiber strand. As explained by David Large, "good engineering practice is to install four fibers from the headend to each node: one for the downstream signals; one for upstream status monitoring, . . . and two more for spares." Declaration of David Large at p. 4.[15]

These four fibers together cost approximately $0.40 per foot, and the associated installation cost ranges from $0.40 per foot to $10.00 per foot in difficult underground installs. Id. The incremental cost over and above the first four fibers is approximately $0.05 per foot per fiber. Therefore, the substantial majority of the cost of upgrades are attributable to

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[14] See, Cable Technical Report & Order, 7 FCC Rcd. 2021 (1992), on recon., 7 FCC Rcd. 8676 (1992).

[15] Coaxial cable upgrades are less economical in comparison to fiber, and thus are not considered a viable alternative. Declaration of David Large at p.6.

improving the basic distribution plant to meet franchise requirements and FCC technical/consumer standards, and should be allocated to the basic and cable services programming tiers. The incremental costs should be allocated to unregulated services.

VIII. CONCLUSION

As shown above, the Commission must be extremely careful not to treat the cable television industry as a public utility. Congress specifically directed the Commission to consider the existing infrastructure of the industry, and Constitutional constraints demand that transitional rules be adopted. Blind adherence to traditional rate of return principles will jeopardize the future development of cable television's role in a competitive telecommunications infrastructure.

The proposals set forth above, articulate a balanced and reasonable approach to implementing the Act. The Group believes that these proposals will avoid unnecessary administrative costs and delays, not only for cable operators, but also for the franchise authorities and the Commission. Moreover, the Group has spent considerable energy in developing these proposals. On or before September 14, the Group will further provide the Commission with Ernst & Young's exhaustive cost-of-service studies, described herein.

Based on the foregoing, the Group respectfully requests that the Commission adopt the proposals set forth herein.

Respectfully submitted,

THE MEDIUM-SIZED OPERATORS GROUP

By: 

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Dated: August 25, 1993

EXHIBIT 1

DECLARATION

I, Leo J. Hindery, Jr., am the Managing General Partner of InterMedia Partners and its affiliates ("InterMedia"), which own and operate cable television systems in 12 states with more than 640,000 subscribers.

InterMedia has been extremely active in the acquisition of cable television systems, and I have been personally and substantially involved in these acquisitions. Specifically, just since 1989, InterMedia has acquired 25 systems, involving approximately $1.06 billion in combined purchase price.

InterMedia cannot determine the "original cost" of construction for any of the above noted acquisitions, due to the fact that the overwhelming majority of these acquisitions were asset purchases in which InterMedia did not acquire the seller's historic balance sheet and because the records necessary to do so are unavailable or do not exist.

I declare under penalty or perjury that the foregoing is true and correct.

Dated: August 24, 1993

Leo J. Hindery, Jr.

EXHIBIT 2

DECLARATION

I, Shirley Coleman Gambone, CPA, am the Treasurer of Prime Venture I, Inc. and its affiliates ("Prime Cable") which own and operate cable television systems in five states with more than 520,000 subscribers.

Prime Cable has been extremely active in the acquisition of cable television systems, and I have been personally and substantially involved in these acquisitions. Specifically, the cable television properties owned by Prime Cable were acquired in ten separate acquisition transactions since 1986 with a combined purchase price of approximately $600,000,000. With one exception, each acquisition was a purchase of assets in which Prime Cable did not acquire the company that previously owned the cable system and, therefore, did not gain access to the seller's books and records. Prime Cable cannot, therefore, determine the "original cost" of construction for the systems acquired in the above noted acquisitions.

I declare under penalty of perjury that the foregoing is true and correct.

Dated: August 24, 1993

EXHIBIT 3

DECLARATION

I, Marc B. Nathanson, am the Chairman of Falcon Holding Group, Inc.("Falcon"), which owns and/or manages cable television systems in 27 states with more than one million subscribers.

Falcon has been extremely active in the acquisition of cable television systems, and I have been personally and substantially involved in these acquisitions. Specifically, just since 1988, Falcon has acquired systems involving over $700 million in combined purchase price.

Falcon cannot determine the "original cost" of construction for any of the above noted acquisitions, due to the fact that the majority of these acquisitions were purchases structured in a manner that Falcon did not acquire the seller's historic balance sheet and because the records necessary to do so are unavailable or do not exist.

I declare under penalty of perjury that the foregoing is true and correct.

Dated: August 24, 1993

Marc B. Nathanson

EXHIBIT 4

DECLARATION

I, John E. Kane, am President of Kane Reece Associates, Inc. ("Kane Reece"). Kane Reece, located in Metro Park, New Jersey, provides valuation, management and technical consulting to the media/communications industries generally and the cable television ("CATV") industry specifically. Our firm has provided services in virtually every state in the United States and in many foreign countries.

I have extensive experience with the valuation of cable television systems. In fact, in the last four years our Firm has appraised over $25 billion of CATV businesses, including the tangible and intangible assets of which these businesses are comprised. The Firm has defended its valuation conclusions before the IRS, in the courts and in other administrative proceedings.

I am familiar with the Federal Communications Commission's (FCC) Notice of Proposed Rulemaking on cost-of-service standards, and I understand that the FCC has proposed to disallow intangibles from cable operator's rate base. From my experience, I estimate that intangible assets comprise approximately 60% to 75% of the current market value of cable television systems in the United States.

CATV intangibles include subscriber relationships and franchise operating rights. CATV is a retail business whose success depends upon the ability to attract and retain subscribers. This is accomplished through enterprise activity. The valuation of the subscriber relationships is based upon the income a subscriber will generate over the statistically determined expected life of the subscription. A method used in determining expected life is known as the retirement rate method. This method is widely recognized and has been used for many years in valuing newspaper subscribers. It is important to note that only the subscribers as of a certain date, usually the acquisition date, are considered. These acquired subscribers will drop off at a predictable rate over time.

The non-exclusive franchise under which cable systems operate have a value generally far in excess of the cost to obtain one de novo. This is because they have been developed. The value of a CATV franchise derives from the bundle of rights granted. These rights include the right to conduct business, market new subscribers and the right to use the public right of ways. Our valuation methodology must and does exclude double counting of income and attributes the appropriate returns to the tangible assets employed.

The high proportion of intangible assets to total assets found in CATV systems is similar to the proportions found in other media/communications businesses such as newspapers, broadcast TV and radio stations, magazines and cellular telephone systems. These businesses generally operate in competitive markets.

Unlike regulated utilities which transfer at net book value, CATV systems are bought and sold at full enterprise value which reflects the value of developed intangible assets. These values are usually far higher than those reflected on the system's financial statements. The financial statements are prepared using generally accepted accounting principles ("GAAP") which only allow the recording of assets at historical costs. The accounting profession in FASB 51, Financial Reporting By Cable Television Companies, requires the capitalization of certain CATV system start-up expenses (losses) to the appropriate asset accounts both tangible and intangible. The FASB recognizes that the development of a cable TV business requires years of effort and expenditures. Thus the FCC should allow these expenditures which are often capitalized as intangible assets to be included in the rate base.

A cable television system is often likened to a utility with monopoly power. No description could be further from reality. In reality it is a regulated, capital intensive, consumer product which is not guaranteed a rate of return by a regulatory authority nor, with many competing entertainment alternatives, does it operate in a truly monopolistic environment as do utilities. Further, in addition to being capital intensive, cable equipment has and will continue to undergo dramatic technological changes. Some changes will put added pressure on cable companies to upgrade existing equipment. Other changes, such as direct broadcast satellites and small flat receive antennas may allow viewers to completely bypass the local cable operator.

CATV systems and companies will be severely debilitated and disadvantaged against other current and potential competitors if only allowed a return on a fraction of their invested capital and if not allowed to amortize intangible assets for rate making purposes.

I declare under penalty of perjury that the foregoing is true and correct.

Dated: August 24, 1993

John E. Kane

EXHIBIT 5

DECLARATION

I, David Large, Director of Engineering for InterMedia Partners am responsible for all engineering activities in InterMedia, a multiple system operator serving over 600,000 subscribers in eleven states.

I have prepared the following statement regarding the necessity for system upgrades to support required performance in the provision of Basic service, the use of fiber-optics for such upgrades, and the incremental fiber-optics cost required to support additional service levels.

I believe that the following analysis will show that many systems will require upgrading to meet the 1995 technical requirements, that fiber-optics is a cost-effective way of doing those upgrades, that the use of fiber-optics will also help meet the requirements for customer telephone response and, finally, that the vast majority of cost is required to provide Basic service with minimal incremental cost attributable to higher level services.

REQUIRED UPGRADES TO SUPPORT BASIC SERVICE

When the FCC re-regulated technical standards for cable systems, they also raised the minimal performance standards. Among many other changes, they increased the standard for the amount of noise and distortion cable systems are allowed to add to carried signals.

Independently, the Cable Act of 1992 specified standards regarding telephone response by cable systems, including such factors as maximum time customers may be on "hold", how often "busy" signals may be encountered, etc.

Both of these new standards will lead to rebuild requirements and the use of fiber as the most economical way to achieve compliance.

Carrier-to-Noise Ratio

Under the previous rules, the minimum acceptable carrier-to-noise radio (C/N) was 36 dB. In fact most older systems were designed to deliver performance about equivalent to the 1993 FCC standards of 40 dB with cascades as long as 30 or so. The Appendix to this memo shows the calculation of the noise buildup in such a system.

Under the new rules, systems must deliver 43 dB C/N minimum after the converter, a 7 dB increase over the old minimum and 3 dB above the performance of a typical system. As the Appendix shows, achieving this with a coaxial upgrade would require the distribution system to improve by more than 6 dB and entail an expensive rebuild, probably including both electronics and cable. The large required increase in plant performance is because the converter represents a significant percentage of the total allowable noise budget.

Dividing the system into smaller cascades through the use of fiber optics allows the existing amplifiers and cable to be used and is generally more cost effective.

Telephone Response

The Cable Act sets strict new standards for cable system's telephone response time. A major problem in older systems is the "tree-and-branch" architecture, almost universally used until the past five years or so. In this system, trunk cables extended from the headend throughout a community, feeding shorter distribution lines in each neighborhood. Typically less than four such trunk lines were used and often just one. Reaching the most distant parts of the network required the series connection of up to 40 or even more trunk amplifiers plus 1-3 local distribution amplifiers.

The reliability of this type of system is limited by the failures of the large number of series-connected elements and also by the fact that power for the amplifiers is taken from various parts of the community, so that customers who may have power may not have cable because the trunk may take part of its power from an area with an outage.

The result of these two factors, is that outages, whether due to localized power outages or failures of electronics early in the cascade, tend to affect large numbers of customers and cause proportionately large instantaneous telephone call rates from customers.

An ongoing problem for cable systems has always been staffing the optimum number of customer service representatives to balance between excess labor costs, which drives up subscription rates, and inadequate telephone response, which results in unhappy customers. To the extent that large numbers of customers try and call simultaneously, it is very difficult to adequately respond.

The use of fiber-optics in upgrades is not only a cost-effective way of achieving the required technical performance, but results in the old cable system being divided into several smaller sections which are independent except for the common electronics in the headend.

In the upgraded network, no single element can result the more than a small percentage of the entire customers losing cable service. Furthermore, since there are fewer devices in series (5 rather than 30 trunk amplifiers in the example given), the probability of failure of service to any given customer is greatly reduced. This results in both fewer total service calls and a reduction of peak loads due to large outages. Thus, the use of fiber-optics to achieve technical performance standards also materially improves the system's ability to meet telephone response standards.

RELATION OF FIBER EXPENDITURE FOR REQUIRED BASIC UPGRADES TO OTHER SERVICE LEVELS

As can be seen, system upgrades will generally be required to meet the 1995 technical requirements, regardless of the presence of enhanced service levels As the analysis in the Appendix shows, fiber-optics are often the most cost-effective means of achieving compliance. The question is whether there is any incremental cost to also support additional service levels. The answer depends on the bandwidth required to support those levels.

Modern AM fiber-optic equipment generally will support 550 MHz bandwidth on a single fiber. Good engineering practice is to install four fibers from the headend to each node: one for the downstream signals, one for upstream status monitoring (and, frequently, for transportation of required PEG channels to the headend) and two more for 100% spares.

When bandwidths in excess of 550 MHz are required, then additional fibers are usually required, at least at the current state of technology. These fibers will cost approximately $.05/ft/fiber. This is incremental to about $.40/foot for the original four fiber cable and an installation cost that can vary from $.40/ft for simple overlash to $10.00/ft or more for difficult underground situations.

SUMMARY

1. System upgrades will be required in many, if not most, systems to meet the 1995 technical performance requirements.

2. The use of fiber-optics is a cost-effective way to achieve the required performance.

3. Upgrading with fiber-optics will also result in both reduced customer trouble calls and reduced peak-to-average call rates, improving systems' ability to meet the 1992 Cable Act requirements for telephone response.

4. The required upgrades to meet standards for Basic service will support up to about 550 MHz bandwidth without incremental expenditure for fiber-optics equipment. Additional bandwidth will, at the current state of technology, typically require the addition of more fibers at an incremental cost that cannot properly be assigned to the provision of Basic service.

APPENDIX: SYSTEM UPGRADE CALCULATIONS

The table below summarizes the calculations used to determine equipment requirements for upgrading a typical current cable system to meet the new FCC C/N requirements.

		Typical Existing All-coax System, 30 Amp Cascade	30 Amplifier Cascade, Coaxial Upgrade	Fiber-Optic Upgrade, 5 amplifier cascade
Factor	Formula			
Minimum C/N requirement, 1995	§76.605(a)	39.7 dB	43 dB	43 dB
+Allowance for Ageing		1 dB	1 dB	1 dB
=Minimum C/N at converter output	Min + Allowance	40.7 dB	44 dB	44 dB
Converter C/N with noisefree 0 dBmV input signal, 13 dB NF	-59+NF	46 dB	46 dB	46 dB
So minimum C/N at converter input	*	42.2 dB	48.3 dB	48.3dB
Plant Gain Variation in trunk w/N amplifiers	(N/10)+3 dB	6.0 dB	6.0 dB	3.5 dB
Minimum average C/N at tap	Min @ conv input + plant variation/2	45.2 dB	51.3 dB	50.1 dB
Fiber Optic Link C/N		n/a	n/a	53 dB
Min Average C/N, coaxial plant	*	45.2 dB	51.3 dB	53.2 dB
Amount by which each amplifier must exceed plant C/N	10 log (N)	14.8 dB	14.8 dB	7.0 dB
Individual Amplifier C/N	Min Ave + Cascade Factor	60 dB	66.1 dB	60.2 dB

Typical Existing System

The calculations for a typical existing, 30 amplifier cascade cable system are summarized in the first column of the table and can be summarized as follows. A single conventional trunk amplifier, with a noise figure of 9 dB and an input level of +10 dBmV will have an output C/N of 60 dB. Since the noise addition of a cascaded series of amplifiers adds as the logarithm of the number of amplifiers, the average noise level of the 30 amplifier cascade will be 14.8 dB lower or 45.2 dB.

Unfortunately, broadband cable systems are do not amplify all signal equally. The generally accepted variation (*NCTA Recommended Practices for Measurements on Cable Television Systems*, Second Edition) in dB is equal to 3 more than the number of trunk amplifiers divided by 10. In this typical system, the variation could therefore be 6 dB. Assuming that that variation occurs equally above and below the nominal gain, the most affected channel will be half that or 3 dB closer to the system noise floor. Therefore the C/N of that channel will be only 42.2 dB. That is the signal that is presented at the input of the converter in the customer's home.

The converter itself, given a typical noise figure of 13 dB and an FCC-mandated minimum signal level of 0 dBmV, will have an output C/N of 46 dB, if fed an ideal noiseless input signal. Combining the system and converter noise will result in a minimum C/N at the converter output of 40.7 dB. Given an additional 1 dB of allowance for system component and cable ageing results in an expected minimum C/N at the input to the customer's equipment of 39.7 dB.

Coaxial Upgrade

The minimum equipment requirements to meet the 1995 FCC minimum C/N specification of 43 dB can be determined by working backwards from the customer's terminal. The results are shown in the second column of the table.

As can been seen, in order to achieve an increase in customer C/N of 3 dB, the C/N of each amplifier must increase by over 6 dB. The reason is that the converter contribution is constant and represents a significant amount of the total allowable noise budget.

The improved amplifier noise performance can be achieved by:

- Increasing the output levels (and thus input levels), but this will require much higher power amplifiers (probably feed-forward) which are very costly and more expensive to run because they consume at least twice the power of conventional amplifiers. Because they are more complex and dissipate more power they also tend to have a higher failure rate.

- Decreasing the loss between amplifiers. This can be achieved by replacing the trunk cable with larger, lower loss cable. Unfortunately, cable replacement is often the most expensive part of system upgrading because of the high labor and material content.

- Decreasing the noise figure of individual amplifiers. Unfortunately, amplifiers are not available with sufficiently low noise figures to achieve the improvement required.

- Some combination of all the above, the most likely solution.

Upgrade Using Fiber Optics

The last column of the table shows the equipment requirements for a rebuild using fiber-

optics to achieve the same performance.

The requirements for the C/N at the input to the converter is the same as for the coaxial upgrade. Since the amplifier cascade is shorter, however, the gain variation as a function of frequency is less, so that the average distribution system performance requirement is not as severe. On the other hand, the noise of the interconnecting fiber-optic link from the headend must be included in the calculation. The biggest factor, however, is that using fiber-optics breaks the system into much shorter cascades of coaxial amplifiers, so that the cascade noise multiplier is only 7 dB instead of 14.8 dB. As a result, each stage only needs to have a C/N of 60.2 dB, almost exactly the capabilities of the original amplifiers.

As a result, while the coaxial upgrade, if it can be achieved, will require replacement of all the electronics and at least some of the cable, an upgrade using fiber-optics can be achieved by merely adding sufficient fiber nodes to the system to break up the long amplifier cascades. The required cable is less expensive and lighter than coaxial cable and can be overlashed to the existing plant, generally without any additional make-ready costs. As a result, upgrading using fiber optics are usually less expensive than straight coaxial upgrades in all but the smallest systems. Few current major upgrades in the cable industry do not involve some use of fiber-optics.

I declare, under penalty of perjury, that the foregoing is true and correct.

(signature) 5/28/93
(date)